


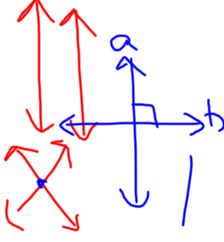
Objectives
In this lesson, you will:

- Determine the number of solutions of a linear system.
- Identify parallel and perpendicular lines.

Key Terms

- system of linear equations
- linear system
- solution
- point of intersection
- parallel lines
- perpendicular lines
- reciprocals

Handwritten notes:
I = _____
C = _____
System. 



Mar 4-7:32 AM

Warm-up: (x, y)
Decide whether each point is a solution of the equation $y = 15x + 280$.

① (2, 310) ② (30, 730)
 $y = 15(2) + 280$ $y = 15(30) + 280$
 $y = 310$ (Yes)

The ordered pairs represent the function $y = 10,400 - 52x$.
Complete each ordered pair.

① (1, 10348) ② (150, 2600)
 $y = 10,400 - 52(1)$
 $y = 10,348$

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$y = 15x + 280$
 (5, 280)
 $\rightarrow (100, 1780)$
 $1780 = 15(100) + 280$
 $1780 = 1500 + 280$
 $1780 = 1780$

$470 = 15(32) + 280$
 $470 = 180 + 280$
 $470 \neq 460$

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SCENARIO A process engineer is performing a time study on a construction site. As part of the study, the work rates of a novice (beginner) bricklayer and a more experienced bricklayer are being recorded. At the beginning of the study, the novice had put _____ into place and was setting the bricks in place at a rate of _____ per hour. The experienced worker started the job after the novice and had put _____ into place so far and was setting the bricks in place at a rate of _____.

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A. For each worker, write an equation that gives the total number of bricks y set in place in terms of the time x in hours after the beginning of the time study.

Novice $\rightarrow y = 38x + 1510$
 Pro $\rightarrow y = 60x + 960$

B. After eight hours of the time study, how many bricks in all will each worker have set into place? Show all your work and use complete sentences in your answer.

$y = 38(8) + 1510 = 1814$
 $y = 60(8) + 960 = 1440$

Which worker has set more bricks into place after eight hours of the time study? Use a complete sentence in your answer.

Novice

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C. After forty hours of the time study, how many bricks in all will each worker have set into place? Show all your work and use complete sentences in your answer.

Novice $\rightarrow 380$
 Pro $\rightarrow 3360$

Which worker has set more bricks into place after forty hours of the time study? Use a complete sentence in your answer.

Pro

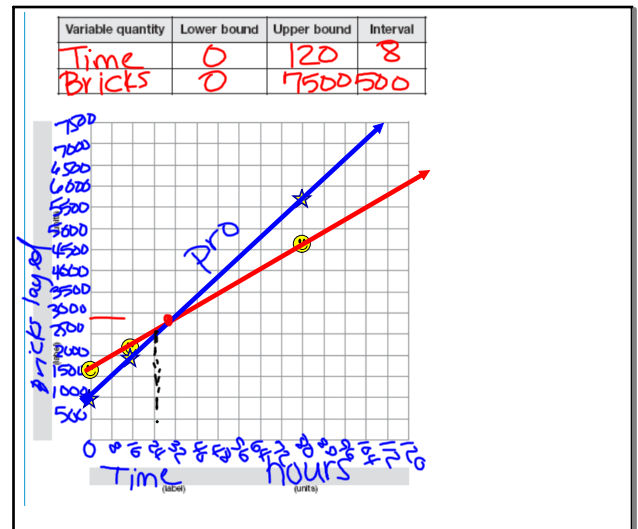
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- D. Find the number of hours that the time study would need to run in order for each worker to set a total of 2460 bricks. Show all your work and use complete sentences in your answer.

$$\begin{array}{r} 2460 = 38x + 510 \\ - 510 \quad - 510 \\ \hline 950 = 38x \\ x = 25 \end{array}$$

$$\begin{array}{r} 2460 = 60x + 960 \\ - 960 \quad - 960 \\ \hline 1500 = 60x \quad x = 25 \end{array}$$

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2. Find the amount of time that it will take in the time study for the number of bricks set by each worker to be the same. Use a complete sentence to explain how you found your answer.

25 hours.

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3. What does the slope of each line represent in this problem situation? Use a complete sentence in your answer.

The slope represents the number of bricks you are increasing by each hour.

Which worker sets bricks faster? How do you know? Use a complete sentence in your answer.

The professional sets bricks faster, because he lays 60 bricks per hour and the novice only lays 38 per hour.

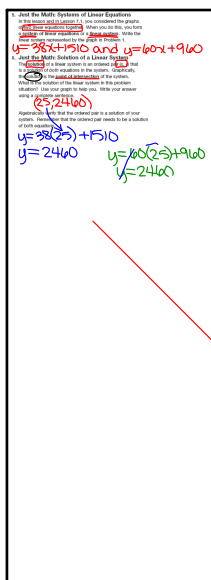
4. What does the y-intercept of each line represent in this problem situation? Use a complete sentence in your answer.

The y-intercept represents the number of bricks that they started with (that were already laid).

How do the y-intercepts of the lines compare? What does this mean in the problem situation? Use complete sentences in your answer.

The novice had a greater y-intercept which means he started more bricks laid.

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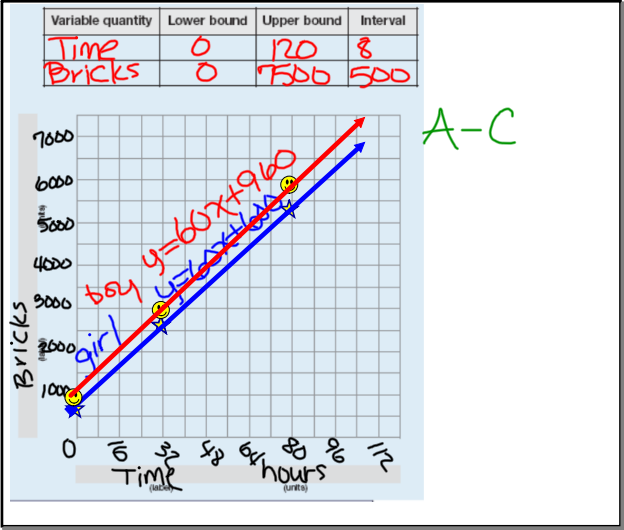
- A. Another experienced bricklayer is having her time recorded as part of the time study. At the beginning of the study, this worker had set 600 bricks so far and can set 60 bricks in one hour. Write an equation that gives the total number of bricks y set in place in terms of the time x in hours after the beginning of the time study.

$$y = 60x + 600$$

- B. Write a linear system that shows the total number of bricks set in terms of time for both experienced workers.

$$\begin{aligned} y &= 60x + 600 \\ y &= 60x + 960 \end{aligned}$$

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1. What does the slope of each line represent in this problem situation? Use a complete sentence in your answer.
- The slope represents the number of bricks you are increasing by each hour.
- Which worker sets bricks faster? How do you know? Use a complete sentence in your answer.
- Both brick setters lay bricks at the same rate.
2. What does the y-intercept of each line represent in this problem situation? Use a complete sentence in your answer.
- The y-intercept represents the number of bricks that they started with (that were already laid).
- How do the y-intercepts of the lines compare? What does this mean in the problem situation? Use complete sentences in your answer.
- The guy has a greater starting amount.

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3. Does there appear to be any point of intersection of the lines?
- No.
4. Use complete sentences to describe how the lines are related to each other.
- The lines are parallel!
The slopes are the same.
5. **Just the Math: Parallel Lines** The lines that you graphed in part (C) are *parallel lines*. Two lines in the same plane are *parallel* to each other if they *do not intersect*. What can you conclude about the slopes of parallel lines? Use a complete sentence in your answer.
- The same.
6. Does the linear system for the two experienced workers have a solution? Use complete sentences to explain your reasoning.
- No, they do not intersect.
7. Will the two experienced workers ever set the same number of bricks during the time study? Use complete sentences to explain your reasoning.



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8. **Just the Math: Number of Solutions of a Linear System** So far in this lesson, we have seen a linear system with one solution and a linear system with no solution. Use complete sentences to describe the graphs of these kinds of linear systems.
- Consider the following linear system:
- $$y = 2x - 4 \text{ and } y = -2(2 - x).$$
- Complete the table of values for this linear system.

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Expressions	x	$2x - 4$	$-2(2 - x)$
	-5		
	0		
	5		
	10		
	12		
	15		

What can you conclude about the number of solutions of this linear system? Use a complete sentence in your answer.

Because every point on the graph of $y = 2x - 4$ is on the graph of $y = -2(2 - x)$, we can say that this system has an *infinite number* of solutions. Use a complete sentence to explain why you think this is true.

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- A. The experienced bricklayer who sets bricks at a rate of 60 bricks per hour and has set 960 bricks so far must set approximately 20,000 additional bricks before the job is done. Write an equation that gives the total number of bricks y left to set in terms of the time x in hours after the beginning of the time study.

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B. Form a linear system with the equation in part (A) and the equation from Problem 1, part (A) that gives the total number of bricks set by this worker in terms of the time after the beginning of the time study.

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Variable quantity	Lower bound	Upper bound	Interval

(units)

(label)

(label)

(units)

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2. What does the point of intersection of the lines represent?

3. Compare the slopes of the lines. Use a complete sentence in your answer.

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4. Are the lines *perpendicular*? That is, do they intersect at a right angle?

5. Consider the graph of your linear system and the equations of the lines. What do you notice about the slopes of perpendicular lines?

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6. **Just the Math: Perpendicular Lines** A property of **perpendicular lines** is that the product of their slopes must be -1 . So, this means that the slopes must have opposite signs and must be reciprocals of each other. For instance, the lines $y = -3x + 4$ and $y = \frac{1}{3}x + 1$ are perpendicular because $-3\left(\frac{1}{3}\right) = -1$. Algebraically show that the lines in your graph in Question 1 are *not* perpendicular. Show your work.

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7. Determine whether the graphs of each pair of equations are parallel, perpendicular, or neither. Show your work and use a complete sentence to explain your reasoning.

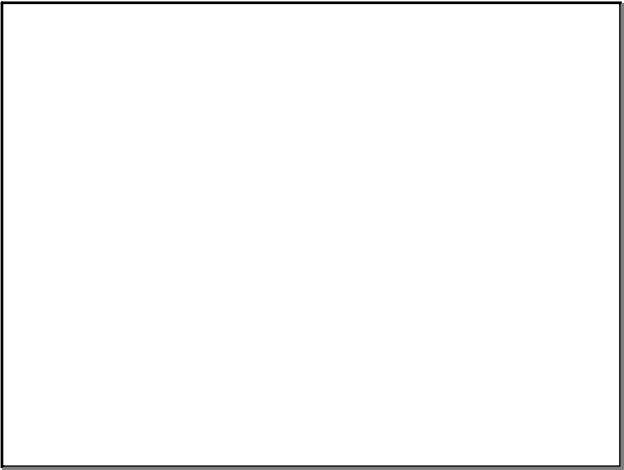
$y = \frac{2}{3}x + 4$ and $y = -\frac{3}{2}x + 1$

$y = 5x - 4$ and $y = -5x + 4$

$y = 4x$ and $y = \frac{1}{4}x - 2$

$y = -1.8x + 15$ and $y = 6 - 1.8x$

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